

CLAIMS

What is claimed is:

5           1.    An apparatus for use in a wellbore, comprising:

an expandable bistable device configured for  
deployment proximate a wellbore wall, the  
expandable bistable device having a  
10           plurality of bistable cells arranged in a  
generally tubular shape, the plurality of  
bistable cells being stable in a collapsed  
configuration and in an expanded  
configuration.

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2.    The apparatus as recited in claim 1, wherein each  
bistable cell comprises at least two elongated members  
connected to each other.

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3.    The apparatus as recited in claim 2, wherein the  
collapsed configuration is a first generally tubular  
configuration and the expanded configuration is a second

generally tubular configuration having a larger diameter than the first generally tubular configuration.

4. The apparatus as recited in claim 3, further  
5 comprising a conveyance device able to transport the expandable bistable device to a desired location in the wellbore.

5. The apparatus as recited in claim 4, wherein the  
10 apparatus further comprises a deployment device able to initiate expansion of the expandable bistable device from its first generally tubular configuration to its second generally tubular configuration.

15 6. The apparatus as recited in claim 4, wherein each cell comprises a first member and a second member, the first member and the second member each comprising a mid-point and two ends, and further wherein the first member is more flexible than the second member.

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7. The apparatus as recited in claim 6, wherein the first and second members are mechanically connected such

that the second member hinders deformation of the first member.

8. The apparatus as recited in claim 7, wherein the  
5 first member has two stable positions, the first stable  
position being where the first member mid-point is adjacent  
to the second member mid-point, the second stable position  
being where the first member mid-point is displaced from  
the second member mid-point to form a gap between the first  
10 member mid-point and the second member mid-point.

9. The apparatus as recited in claim 6, wherein the  
second member has a greater thickness than the first  
member.

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10. The apparatus as recited in claim 6, wherein the  
thickness ratio of the second member to the first member is  
greater than approximately 3:1.

20 11. The apparatus as recited in claim 6, wherein the  
thickness ratio of the second member to the first member is  
greater than approximately 6:1.

12. The apparatus as recited in claim 4, wherein the bistable device further comprises a wrapping attached to the outer surface of the bistable device.

5        13. The apparatus as recited in claim 12, wherein the wrapping comprises an expandable screen.

14. The apparatus as recited in claim 4, wherein the bistable device further comprises a deformable material  
10 attached to the outer surface of the bistable device.

15. The apparatus as recited in claim 14, wherein the deformable material comprises an elastomer.

15        16. The apparatus as recited in claim 15, wherein the elastomer is selected to be resistant to crude oils, brines, and acids encountered in oil and gas wells.

17. The apparatus as recited in claim 4, wherein the  
20 bistable device in its second generally tubular configuration comprises a plurality of diameters.

18. A method of stabilizing an uncased section of a wellbore in an underground formation, comprising:

providing an expandable bistable device having a  
5 generally tubular shape that comprises a  
plurality of bistable cells;

placing the bistable device at a position in the wellbore while in a first stable state; and

10 radially expanding the bistable device to a second  
stable state having a generally tubular  
configuration without substantially reducing  
axial length.

15 19. The method as recited in claim 18, further  
comprising attaching a wrapping to the outer surface of the  
bistable device.

20 20. The method as recited in claim 19, wherein  
attaching comprises attaching an expandable screen.

21. The method as recited in claim 18, further comprising applying a deformable material to the outer surface of the bistable device.

5           22. The method as recited in claim 21, wherein applying comprises applying an elastomeric material.

23. The method as recited in claim 18, wherein radially expanding comprises expanding the bistable device  
10 to a plurality of final diameters.

24. A method for installing liners within a tubular located in a wellbore, comprising:

15           forming an expandable bistable device with a plurality of bistable cells, the expandable bistable device having a generally tubular shape;

20           surrounding the expandable bistable device with an expandable liner element attached to an outer surface of the bistable device;

placing the expandable bistable device at a  
position within a tubular while in a first  
stable state; and

5           expanding the expandable bistable device into a  
second stable state to hold the liner  
element against an inner diameter of the  
tubular.

10           25. The method as recited in claim 24, further  
comprising locating multiple bistable devices in the  
wellbore such that the ends of the adjacent bistable  
devices overlap and form a continuation of the liner  
element against the inner diameter of the tubular.

15           26. The method as recited in claim 24, further  
comprising creating each bistable cell with a thin strut  
connected to a thick strut.

20           27. A method for facilitating use of a wellbore,  
comprising:

inhibiting sand influx into a wellbore, wherein  
inhibiting comprises:

5                   placing a bistable device at a desired position  
                    in a wellbore; and

                    expanding the bistable device at least partially  
                    through a nonstable range towards a stable  
                    state until the bistable device is able to  
10                   exert hoop stress forces against the  
                    wellbore.

28. The method as recited in claim 29, further  
comprising attaching a wrapping to an outer surface of the  
15   bistable member.

29. The method as recited claim 30, wherein attaching  
comprises attaching an expandable screen.

20           30. A method of facilitating use of a wellbore,  
comprising:



isolating a portion of a wellbore with an  
expandable bistable device having a generally  
tubular shape formed by a plurality of  
bistable cells that permit the expandable  
5       bistable device to be selectively actuated  
between a contracted state and an expanded  
state.

31. A method of sealing a portion of a wellbore  
10   tubular, comprising:

locating a bistable device within a wellbore tubular  
adjacent to a zone to be sealed; and

15       expanding the bistable device against the wellbore  
tubular by moving the bistable device through a  
nonstable region towards an expanded stable  
state.

20       32. An apparatus for use in a wellbore, comprising:

a wellbore conduit having at least one bistable  
device.

33. The apparatus as recited in claim 34, wherein the  
bistable device comprises a plurality of bistable cells,  
each bistable cell comprising at least two elongated  
5 members that are connected to each other at their ends, the  
device being stable in a first generally tubular  
configuration and a second generally tubular configuration,  
wherein the second generally tubular configuration has a  
larger diameter than the first generally tubular  
10 configuration.

34. The apparatus as recited in claim 35, wherein the  
apparatus further comprises a conveyance device able to  
transport the apparatus to a location in a borehole.

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35. The apparatus as recited in claim 36, wherein the  
apparatus further comprises a deployment device that  
initiates the expansion or collapse of the bistable device.

20 36. A system for facilitating communication along a  
wellbore, comprising:

an expandable tubing having a communication line  
passageway.

37. A system for facilitating communication along a  
5 wellbore, comprising:

an expandable tubing formed of a plurality of bi-  
stable cells, the expandable tubing having a  
communication line passageway.

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38. The system as recited in claim 39, wherein the  
communication line passageway is defined by a thinned  
portion along the expandable tubing.

15 39. A wellbore tubular, comprising:

and expandable bistable tubing; and

a device mounted to the tubing.

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40. The tubing of claim 41, wherein the device is  
selected from an electrical device, a measuring device, a  
meter, a gauge, and a sensor.

41. A method of routing a communication line in a well, comprising:

deploying an expandable tubing in a well;

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routing at least a portion of a communication line adjacent at least a portion of the expandable tubing; and

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expanding the expandable tubing.

42. The method as recited in claim 43, wherein deploying comprises running an expandable tubing formed of bistable cells into a well.

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43. The method as recited in claim 43, wherein routing comprises routing a cable along an exterior of the expandable tubing.

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44. The method as recited in claim 44, further comprising attaching the communication line to the expandable tubing as the expandable tubing is deployed in the well.

45. The method as recited in claim 44, further comprising forming a communication line passageway in the expandable tubing to receive the communication line.

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46. The method as recited in claim 47, wherein forming comprises forming the communication line along a thick strut formed between a plurality of bistable cells.

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47. The method as recited in claim 44, further comprising providing a device attached to the expandable tubing.

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48. The method as recited in claim 49, wherein providing comprises attaching a sensor.

49. The method as recited in claim 49, wherein providing comprises attaching an instrument.

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